

APPENDIX J

IGLOO G AIR MONITORING PLAN

1.0 INTRODUCTION

This appendix describes the U.S. Army Dugway Proving Ground (DPG) air-monitoring plan for Igloo G. This appendix is part of the Resource Conservation and Recovery Act Part B hazardous waste permit for Igloo G.

The objective of this plan is to describe air monitoring policies and procedures to ensure that:

- Harmful vapors are not released to the environment
- Personnel are not exposed to harmful vapors
- Chemical agent spills are detected in a timely manner

This plan describes the policies, requirements, and responsibilities for air monitoring of chemical warfare materiel (CWM) which includes range recovered munitions (RRM) at Igloo G. It includes the following sections:

- Facility Description
- Analytical Parameters
- Sampling and Analysis
- Frequency of Monitoring
- Response to Agent Detection
- Plan Review and Evaluation

Tables and figures appear as close as possible to where they are first mentioned.

2.0 FACILITY DESCRIPTION

This section describes Igloo G and its vapor controls.

2.1 General Description

Igloo G is located at Carr Facilities on DPG. The structure is designed to protect and safely store CWM at DPG.

Igloo G is a concrete structure measuring 26 feet wide by 80 feet long covered with 2 feet of earth. The inside temperature of Igloo G is passively maintained at approximately 21 degrees Celsius (70 degrees Fahrenheit) year around. The air monitoring equipment is powered with a mobile generator.

Igloo G is equipped with an intrusion alarm system and 24-hour exterior lighting. High security chain link fencing surrounds the entire structure. Large barricades ("King Tut" barricades) are placed in front of the entrance. Security personnel visually monitor Igloo G on a daily basis.

Igloo G is used to store CWM including:

- G series (GA, GB, GD, GF)
- V series (VX)
- H series (HD)
- Lewisite

Sampling lines transfer air from specific locations in Igloo G to monitoring equipment located in the monitoring room or monitoring trailer. Sampling lines vary in length from a few feet to over 50 feet. All sampling lines are made of Teflon[®] and are heated to prevent condensation. Vacuum pumps are used to pull air from each sampling point to the monitoring device.

2.2 Vapor Controls

The ventilation design of Igloo G, with its minimal airflow, works to contain potential vapor releases resulting from leakage or spills. Figure 1 depicts the airflow in Igloo G. The igloo has two vents, one on each side of the front doors. There is one round vent on the back wall near the roof. Outside air enters the igloo through two vents in the front and exits through the vent near the roof. The airflow exchange rate is 25 to 30 cubic feet per minute. A complete exchange of air within the igloo requires approximately 15 hours. This low rate allows heavier-than-air vapors to collect at floor level.

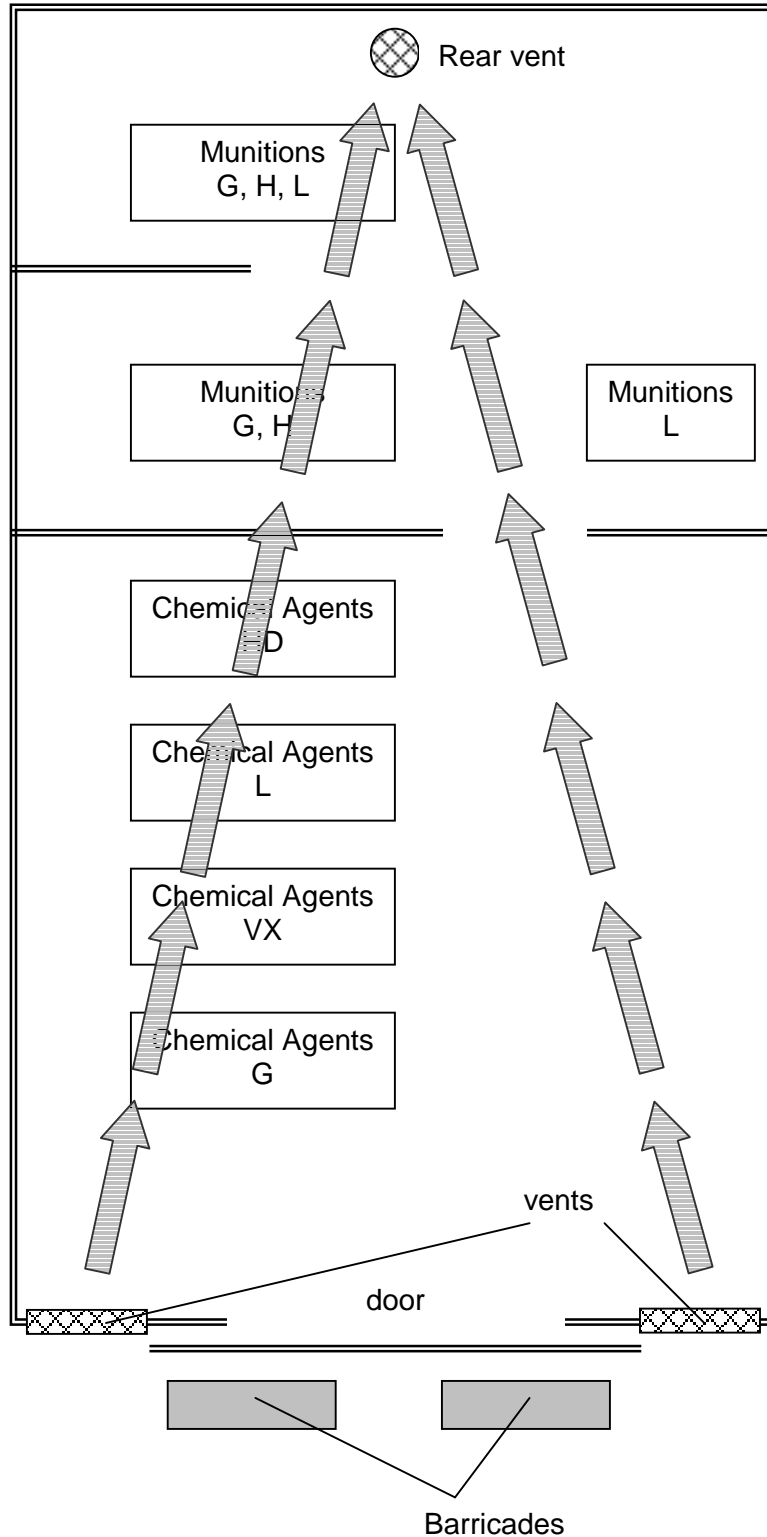
Under normal circumstances, Igloo G vent filters are unnecessary. If a release of chemical agent is confirmed, a mechanical vapor filter system is immediately attached to the roof vent and operated to prevent the release of harmful vapors.

3.0 ANALYTICAL PARAMETERS

Air monitoring analytical parameters include each chemical agent stored in Igloo G. A list of the chemical agents stored in Igloo G and their 8-hour time weighted averages (TWAs) / chemical control limits (CCL) are presented in Table 1.

Table 1 Action Levels for Chemical Agents Stored in Igloo G.			
Chemical Agent	TWA/CCL (milligrams per cubic meter)	Action Level Factor	Action Level (milligrams per cubic meter)
GA	0.0001	0.2	0.00002
GB	0.0001	0.2	0.00002
GD	0.00003	0.2	0.000006
GF	0.0001	0.2	0.00002
VX	0.00001	0.2	0.000002
HD	0.003*	0.2	0.0006
Lewisite	0.003*	0.4	0.0012
GA ethyl N,N-dimethylphosphoramidocyanidate HD bis (2-chloroethyl) sulfide GB isopropyl methylphosphonofluoridate GD pinacolyl methylphosphonofluoridate GF cyclohexyl methylphosphonofluoridate VX o-ethyl s-2-diisopropylaminoethyl methylphosphonothioate L Chlorovinyl dichloroarsine * CCL Chemical Control Limit – This is a ceiling value. A ceiling value should not be exceeded at any time.			

Figure 1. Airflow Pattern in Igloo G.



4.0 SAMPLING AND ANALYSIS

Igloo G air monitoring samples are collected and analyzed according to the Quality Assurance Program Plan, Appendix A, of this permit, or equivalent methods approved by the Executive Secretary. Typical sampling methods include Miniature Continuous Air Monitoring System (MINICAMS®), bubblers, and Depot Area Air Monitoring System (DAAMS). Analysis methods include MINICAMS® and gas chromatography (GC) specified in Attachment 1 and Appendix A.

Primary and secondary sampling and analysis methods are listed in Table 2. Typical locations of sampling points and air monitors are shown in Figure 2.

Table 2. Igloo G Sampling and Analysis Methods.			
Chemical Agent	Primary Sampling and Analysis Method(s)	Secondary Sampling and Analysis Methods	
GA	MINICAMS®	DAAMS with gas chromatography	
GB	MINICAMS®	DAAMS with gas chromatography or Bubbler with gas chromatography	
GD	MINICAMS®	DAAMS with gas chromatography or Bubbler with gas chromatography	
GF	MINICAMS®	DAAMS with gas chromatography	
VX	MINICAMS®	DAAMS with gas chromatography or Bubbler with gas chromatography	
HD	MINICAMS®	DAAMS with gas chromatography	
Lewisite	MINICAMS®	Bubbler with gas chromatography	
GA	ethyl N,N-dimethylphosphoramidocyanidate	GF	cyclohexyl methylphosphonofluoridate
GB	isopropyl methylphosphonofluoridate	MINICAMS®	Miniature Continuous Air Monitoring System
GD	pinacolyl methylphosphonofluoridate	VX	o-ethyl s-2-diisopropylaminoethyl methylphosphonothioate
L	Chlorovinyl dichloroarsine		
HD	bis (2-chloroethyl) sulfide		

4.1 MINICAMS®

MINICAMS® portable GC systems are the primary tool for monitoring chemical agents. MINICAMS® analysis is performed after monitoring lines have been thoroughly purged. MINICAMS® analysis is performed by drawing a specific volume of air through the instrument's pre-concentrator tube. Chemical agent analytes are retained on the pre-concentrator tube materials. Chemical agents are desorbed from the pre-concentrator tube into the GC where they are separated from each other in the GC column. The chemical agents are then detected as they elute from the GC column. The MINICAMS® is configured specifically for each chemical agent.

The following quality control (QC) requirements apply to Igloo G air monitoring using MINICAMS®.

Instrument operators should have documented training in the analysis and reporting of chemical agents.

Calibration should be performed each time the instrument is moved to a new location, if significant changes are made to the instrument, or if the calibration verification standard also known as QC standard fails more than twice consecutively.

Calibration should be performed using liquid standards with known and documented concentrations.

Calibration should be performed with at least one standard at a liquid concentration approximately equivalent to the 8-hour TWA/CCL level for each analyte.

A calibration verification must be performed at the action level for each analyte in Table 1.

A calibration verification standard also known as QC standard should be analyzed at the beginning and end of each run.

The calibration verification standard recovery at the action level shall be greater than 50% recovery.

The calibration verification standard at the TWA/CCL recovery should be within ± 25 percent.

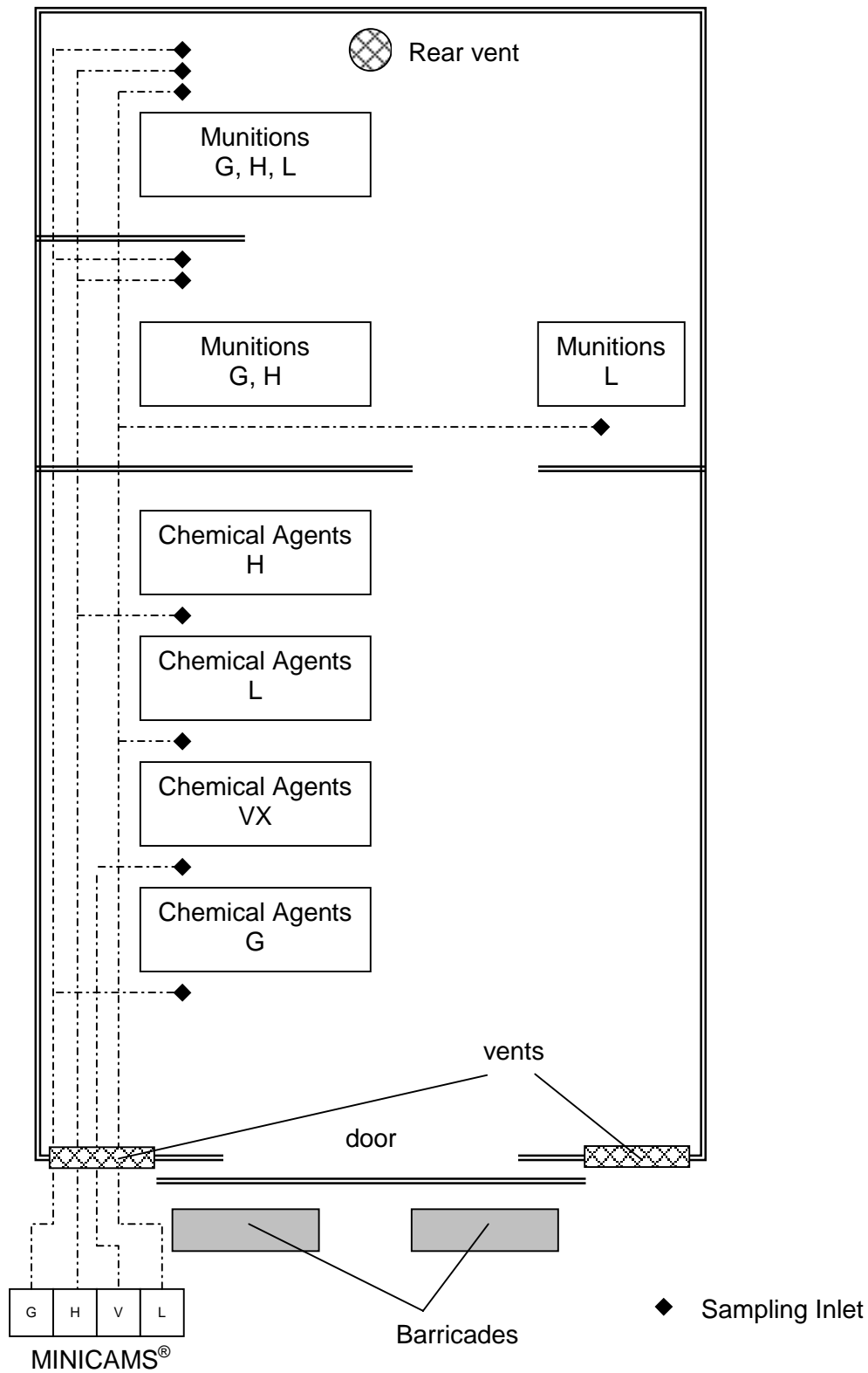
Documentation should enable an independent reviewer to easily recreate all aspects of standard preparation, sample analysis, and reporting.

Raw data should be clearly indicate:

- Identification of each standard and sample run also known as “shot”
- Name of operator
- Date of analysis
- Instrument number
- Sample line location
- Start and end times of sample collection
- Start and end flow rates
- Start and end QC results
- Calibration verification standard also known as QC standard identification number
- Volume of calibration verification standard also known as QC standard injected
- Operator’s initials and date of sampling

All raw and summary data should be readily available for review.

Figure 2. Location of Sampling Points and Monitoring Locations.



4.2 Bubblers SAMPLING with Gas Chromatography Analysis

Bubblers are used to collect samples for quantitative analysis of Lewisite. Bubblers may also be used to collect GB, GD, and VX for subsequent GC analysis. Analysis is performed after monitoring lines have been thoroughly purged. Bubbler sampling is performed by drawing a specific volume of air through a sorbent solution. 120 liters (L) of air is collected by sampling for 120 minutes at a flow rate of 1.0 L per minute. The solution is transferred to the laboratory for GC analysis.

An organic solvent, such as chloroform, is used to extract chemical agents from the bubbler solution. GC analysis is performed by injecting a known volume of the extract into the GC where chemical agents are separated from each other in the GC column. The chemical agents are then detected as they elute from the GC column. The GC is configured to detect each chemical agent.

The following QC requirements apply to Igloo G air monitoring using bubblers and subsequent GC analysis.

Sample collection personnel should have documented training in the collection of chemical agents.

Instrument operators should have documented training in the analysis and reporting of chemical agents.

Samples should be delivered to the laboratory as soon as possible after collection.

Samples should be maintained on ice or in a refrigerator prior to analysis.

Calibration should be performed for each run.

Calibration should be performed with at least one standard at a liquid concentration approximately equivalent to the 8-hour TWA/CCL level for each analyte.

A calibration verification standard also known as QC standard should be analyzed at the beginning and end of each run.

Calibration verification standard also known as QC standard recovery should be within ± 15 percent.

Documentation should enable an independent reviewer to easily recreate all aspects of standard preparation, sample analysis, and reporting.

Bubbler sample collection documentation should clearly indicate:

- Name of sample collection personnel
- Date of sample collection
- Sampling location
- Bubbler identification number
- Volume of bubbler solution
- Start and end time of sample collection
- Flow rate
- Ambient temperature

GC raw data should clearly indicate:

- Instrument and method parameters
- The identification of each standard and sample
- Name of operator
- Date of analysis
- Instrument number
- Start and end QC results
- Calibration and calibration verification standards also known as QC standard identification numbers
- Operator's initials and date

All raw and summary data should be readily available for review.

4.3 Depot area air monitoring system SAMPLING with Gas Chromatography Analysis

DAAMS solid sorbent tubes should be used for collecting samples for analysis of chemical agents other than Lewisite. Analysis is performed after monitoring lines have been thoroughly purged. Sample collection is performed by drawing a specific volume of air through a DAAMS sorbent tube. The DAAMS tube is transferred to the laboratory for GC analysis.

GC analysis is performed by first, desorbing the DAAMS tube onto the instrument transfer tube. Chemical agents are then desorbed from the transfer tube into the GC where they are separated from each other in the GC column. The chemical agents are then detected as they elute from the GC column. The GC is configured to detect each chemical agent.

The following quality control requirements apply to Igloo G air monitoring using DAAMS and subsequent GC analysis.

- Sample collection personnel should have documented training in the proper collection of chemical agents.
- Instrument operators should have documented training in the proper analysis and reporting of chemical agents.
- Samples should be delivered to the laboratory as soon as possible after collection.
- Samples should be maintained on ice or in a refrigerator prior to analysis.
- Calibration should be performed for each run.
- Calibration should be performed with at least one standard at a liquid concentration approximately equivalent to the action level in Table 1 for each analyte.
- A calibration verification standard also known as QC standard should be analyzed at the beginning and end of each run.
- QP Calibration verification standard also known as QC standard recovery should be within ± 15 percent.
- Documentation should enable an independent reviewer to easily recreate all aspects of standard preparation, sample analysis, and reporting.
- DAAMS sample collection documentation should clearly indicate:
 - Name of sample collection personnel
 - Date of sample collection
 - Sampling location
 - DAAMS identification number
 - Volume of bubbler solution
 - Start and end time

- Flow rate
- Ambient temperature
- GC raw data should clearly indicate:
 - Instrument and method parameters
 - The identification of each standard and sample
 - Name of operator
 - Date of analysis
 - Instrument number
 - Start and end QC results
 - Calibration and calibration verification standard also known as QC standard identification numbers
 - Operator's initials and date
- All raw and summary data should be readily available for review.

5.0 FREQUENCY OF MONITORING

First entry monitoring is performed prior to entry into Igloo G for any reason. Safety inspections and air monitoring is conducted at least once per month. Air monitoring is performed by trained and qualified personnel.

Monitoring begins before the door of Igloo G is opened and continues during chemical agent operations. At least two MINICAMS[®] cycles are completed with negative readings prior to entering the igloo. When alternate methods are used analysis is completed and negative results received before the first entry crew enters the igloo.

6.0 RESPONSE TO AGENT DETECTION

The MINICAMS[®] signals an alarm when it detects chemical agent above the action level listed in Table 1.

If the MINICAMS[®] alarms during monitoring prior to entry, the MINICAMS[®] operator informs the officer in charge of operations. The MINICAMS[®] operator immediately starts procedures to confirm the initial reading and all non-essential personnel are evacuated. If agent release is confirmed the officer in charge requests vapor filter hook-up, and notifies the installation Safety Office.

If the MINICAMS[®] alarms during operations, the MINICAMS[®] operator informs the officer in charge of operations and immediately starts procedures to confirm the initial reading. Personnel immediately exit the igloo. If agent release is confirmed the officer in charge requests vapor filter hook-up, and notifies the installation Safety Office.

7.0 PLAN REVIEW AND EVALUATION

The Directorate of Environmental Programs regularly reviews and evaluates this Air Monitoring Plan to ensure suitability and effectiveness. The results of the review are documented, and any changes implemented are followed with verification of implementation.

The review includes the following:

- Review and evaluation of internal and external audit findings
- Consideration of external influences such as new technology, changing or new regulations, organizational changes, etc.
- Recommendations by safety personnel and employees